OPERATOR'S MANUAL

HANDISCOPE MODEL 466

SIMPSON ELECTRIC COMPANY

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1-73 NMJ HINZ

Printed in U.S.A.
1-116957

FIGURE 1. SIMPSON HANDISCOPE MODEL 466.

SPECIFICATIONS

VERTICAL AMPLIFIER

Frequency Response	15 to 100 kc, ±1 db, 6 db down at 250 kc, useful to 1 mc.
Maximum Sensitivity	0.03 volts RMS per inch
Input Impedance	0.1 megohm on X1 position - 40 $\mu\mu$f 0.5 megohm on X100 position - 35 $\mu\mu$f

HORIZONTAL AMPLIFIER

Frequency Response	Useful to 1 megacycle
Maximum Sensitivity	0.7 volts RMS per inch
Input Impedance	0.25 megohm - 40 $\mu\mu$f

SYNCHRONIZATION

Positive or negative from vertical amplifier or from external source.

SWEEP GENERATOR

Multivibrator type, with frequency range from 15 to 80,000 cycles.

TUBE COMPLEMENT

3 each type 12AU7 vert. amplifier and multivibrator.
1 each type 12AT7 horiz. amplifier.
2 each type 6C4 phase shifter and blanking amplifier.
1 each type 5UP1 cathode ray tube.
2 each type 5Y3 rectifiers.

POWER REQUIREMENTS

105 to 125 volts, 50 or 60 cycles AC, 50 watts.

POWER CABLE

The three-conductor power cable supplied with this instrument is terminated in a polarized three-prong male connector recommended by the National Electrical Manufacturers' Association. The third contact is an offset round pin added to a standard two blade connector-which grounds the instrument

chassis when used with an appropriate receptacle. To use this connector in a two-contact receptacle, a three-prong to two-prong adapter should be used.

DIMENSIONS, OVERALL

7-7/8 inches wide by 12-1/4 inches high by 16-1/8 inches deep. Net weight 19 lbs.

DESCRIPTION

The Simpson Handiscope Model 466 is an AC operated portable type oscilloscope which may be used for general purpose applications. It will provide waveforms for voltage and current analysis on a large 5-inch tube. Its convenient controls provide adequate, and yet simplified, operation.

The Handiscope contains horizontal push-pull amplification for the X axis, vertical push-pull amplification for the Y axis, and an intensity modulation input for the Z axis. Horizontal deflection may be obtained from either the internal sweep circuits or from an external signal voltage.

CAUTION

The power supply in the Handiscope contains high voltage circuits for the cathode ray tube. Be very careful to prevent contact with high voltage whenever the instrument is removed from its cabinet.

OPERATION

Figure 1 shows the front panel arrangement of controls. Use the controls as follows:

INTENSITY

The INTENSITY control adjusts for brightness of the pattern on the cathode ray tube, and it also has the on-off power switch for the instrument. In its extreme counter-clockwise position, power is turned off. Turn the control to the right to turn on power. After a warm-up period set the control at the

lowest level which permits satisfactory viewing. Avoid high intensity where possible; a high intensity spot or trace which remains stationary on the cathode ray tube may burn its screen.

FOCUS

The FOCUS control affects the sharpness of the trace or spot. Set it in the position which provides the finest line, or the smallest spot, after the INTENSITY control has been set.

VERT. POS.

Adjustment of this control moves the trace or spot up and down on the tube face. Set it at the position which places the trace or spot in the desired vertical position.

HORIZ. POS.

Adjustment of this control moves the trace or spot to the right and to the left on the tube face. Set it at the position which places the trace or spot in the desired horizontal position.

BLANKING

When operating with an internal sweep, set this control so the forward trace will be seen on the tube face, but the return trace will not be seen. When operating with an external horizontal input, set this control at OFF to permit viewing of the entire input waveform.

SYNC

When operating with an internal sweep, set this control so the waveform pattern on the tube face will remain stationary. Use as low a setting as will furnish this condition. Note that the control is off when its knob is pointing straight up, at the 0 mark. Increase its setting as required for each application in either direction as desired.

FINE FREQ.

This control will select any sweep frequency within the range which is set by the position of the COARSE FREQ. switch.

PHASE

The PHASE control adjusts the phase relationships between an internal sine wave sweep at the line frequency and a signal which is providing vertical deflection. This combination is used for FM and television waveform analysis. To operate the internal sweep multivibrator, set the phase control at OFF.

VERT. GAIN

This is the fine control which adjusts the vertical deflection on the tube face.

VERT. ATTEN.

This is the coarse control which adjusts the vertical deflection on the tube face. Set it at X100 for large vertical input

voltages, or at X1 for small input voltages. When in doubt, set this switch at X100; if the VERT. GAIN. control will not provide enough deflection, set the VERT. ATTEN. switch at X1. Be sure that the maximum voltage applied does not exceed 400 volts.

COARSE FREQ.

This six-position switch selects the ranges of frequencies for internal sweep operation. In the extreme left position, the sweep circuits are turned off, and the HOR. INPUT will furnish any signal connected to it into the horizontal deflection circuits. In each of the other five positions, the sweep circuits will be turned on and the HOR. INPUT will be disconnected. The approximate range of frequencies at each position is shown by the markings between switch positions; adjust the FINE FREQ. control to select any frequency within the range.

HORIZ. GAIN

This is the control which adjusts for horizontal gain on the tube face for either internal sweep operation or external horizontal inputs.

SYNC SWITCH

This two-position slide switch, marked INT. and EXT. selects the input to the SYNC control above. When the signal which is connected as the vertical input is to be used for synchronization, set the switch at INT. When another signal source is connected to the EXT. SYNC.

binding post to be used for synchronization of the trace, set this switch at EXT.

BINDING POSTS

Six binding posts across the bottom of the front panel provide convenient connections for all inputs, and provide an AC sine-wave output which may be used for testing and calibration. Two ground posts (GND.) are furnished for convenience. Connect a signal for vertical deflection to the VERT. INPUT and GND. binding posts. Connect a signal for horizontal deflection to the HOR. INPUT and GND. binding posts. Connect an external synchronization signal to the EXT. SYNC. and GND. binding posts. To use the 1 volt peak-to-peak AC output for testing or calibration of either the vertical or the horizontal deflection circuits, connect a jumper wire from the 1 V P-P binding post to either the VERT. INPUT or the HOR. INPUT binding post; the ground connection is already made through the instrument circuits.

NOTE

Do not apply more than 400 volts to the vertical input, nor more than 150 volts to the horizontal input of the Handiscope.

DIRECT INPUTS

For special applications, it may be desirable to make vertical and horizontal deflection input connections directly to the plates of the cathode ray tube rather than through the

Model 466 amplifiers. A terminal board in the rear of the instrument will permit these connections. The terminals are D1, D2, D3, and D4. D1 and D2 are for the horizontal deflection plates, D3 and D4 are for the vertical deflection plates.

To connect directly to the horizontal deflection plates, first turn off oscilloscope power. Remove the jumper wires connected to D1 and D2. For AC inputs, connect a .001 μf capacitor with sufficient voltage rating in series with one of the leads from the input, and connect the input to the D1 and D2 terminals.

To use the direct input for vertical deflection, first turn off oscilloscope power. Remove the jumper wires connected to D3 and D4. Then connect a .001 μf capacitor in series with one of the leads from the input, and connect the input to the D3 and D4 terminals.

After using direct inputs, always turn off power before removing input connections. Restore normal operation by connecting the jumper wires in their original circuit arrangement.

INTENSITY MODULATION

Intensity, or Z-axis, modulation affects the control grid bias of the cathode ray tube for phase comparisons, frequency markings, and other special effects. Connect the input between the INT. MOD. terminal of the rear terminal board and ground. With a normal intensity in use, approximately 20 volts will be required to blank the trace.

APPLICATIONS

An oscilloscope may be used to measure voltage, frequency, and wave form in any varying potential. It may also be used to compare phase and amplitude between two voltage sources. It may also be used to identify conditions of tuning and operation in any special tuned circuit; detailed instructions for such alignment will always accompany the equipment to be analyzed and adjusted.

MEASURING VOLTAGES

For any given setting of the gain controls, the amount of deflection on the cathode ray tube is proportional to the input voltage. To measure voltage in terms of deflection, compare the deflection due to the signal input with the deflection due to a known signal source voltage. For convenience, a 1 volt peak-to-peak waveform is available from the binding post marked 1 V P-P on the front panel. To compare the vertical deflection from an input signal against this source, note the amount of vertical deflection on the cathode ray tube with a convenient setting of the gain controls. Then disconnect the signal input from the VERT. INPUT binding post, and connect a wire from the 1 V P-P to the VERT. INPUT post. Observe deflection with this signal without changing the gain controls. Comparison of the two amounts of deflection will indicate the relative amplitude of the two signals.

FREQUENCY COMPARISON

The frequencies of any two signal sources can be compared with the Simpson Handiscope Model 466. Set the COARSE FREQ. control at EXT., the PHASE control at OFF, and connect the two signals to the vertical and horizontal inputs of the Handiscope; connect one signal to the VERT. INPUT and GND. binding posts and the other to the HOR. INPUT and GND. binding posts. Adjust the vertical and horizontal gain for convenient deflections.

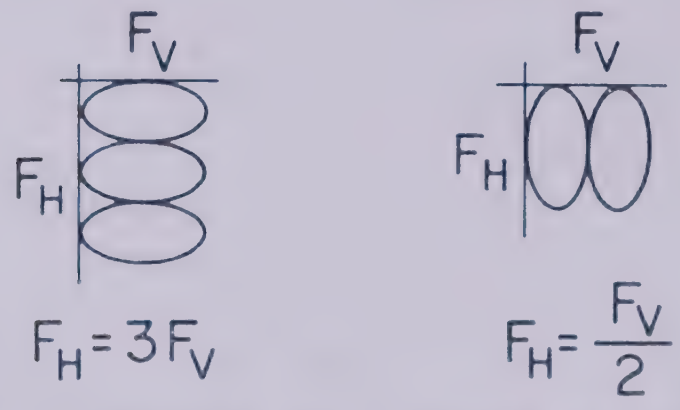

FIGURE 2. MEASURING RELATIVE FREQUENCIES OF VERTICAL AND HORIZONTAL INPUTS.

The pattern on the oscilloscope will be a Lissajou pattern, as shown in figure 2. To determine the ratio between the frequencies, draw an imaginary line tangent to the loops in the pattern; count the number of pattern loops which touch each of the tangents. The frequency ratio is equal to the ratio of loops. If either frequency is known, the other can be determined through the ratio.

MEASURING PHASE RELATIONS

To measure the phase relations between two AC voltages which have the same frequency, use the following steps.

1. Set the COARSE FREQ. switch at EXT.
2. Connect one signal source to the VERT. INPUT and GND. binding posts, and the other signal source to the HOR. INPUT and GND. posts.
3. Set the VERT. GAIN and HORIZ. controls to obtain the same amount of deflection for each signal. For example, set the VERT. GAIN control for a 3-inch vertical deflection, and then set the HORIZ. GAIN control for a 3-inch horizontal deflection.

0° PHASE DIFF. | 45° PHASE DIFF. | 90° PHASE DIFF. | 135° PHASE DIFF. | 180° PHASE DIFF.

FIGURE 3. LISSAJOU FIGURES SHOW PHASE RELATIONS.

4. Compare the pattern on the cathode ray tube to the patterns in figure 3. This will show the approximate phase relations between the two input signals.
5. For computing phase relations, measure vertical deflection quantities A and B as shown in figure 4. Divide quantity A by quantity B to obtain the sine of the phase angle. Determine the phase angle from a table of trigonometric sine values.

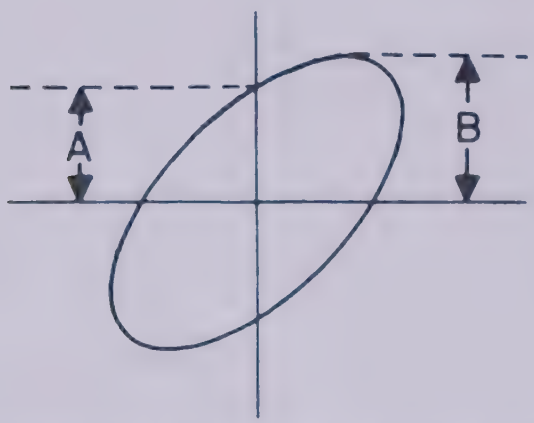

FIGURE 4. MEASUREMENTS FOR CALCULATING PHASE RELATIONS.

AUDIO CIRCUIT ANALYSIS

To determine the overall operating characteristics of an audio amplifier, connect an audio oscillator to its input, and observe the waveform at its output with the Handiscope. If the shape is a pure sine wave, the same as is being delivered into the amplifier, this would indicate proper operation. Any distortion of the output waveform indicates improper amplification.

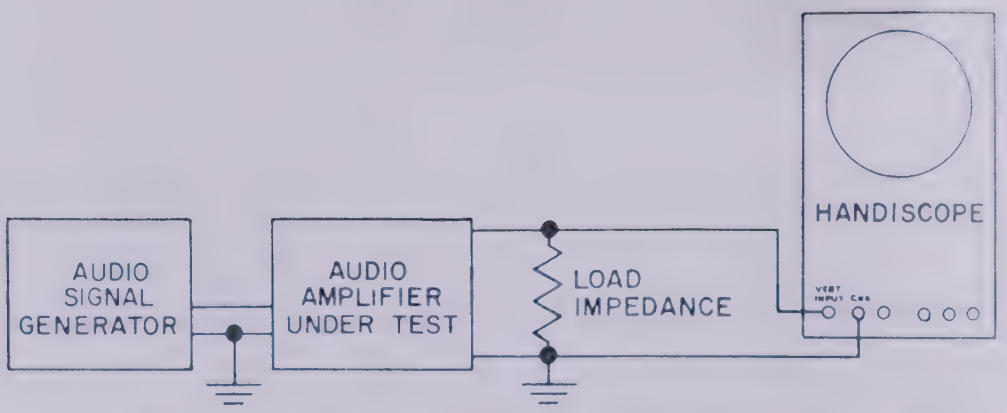

FIGURE 5. CONNECTIONS FOR TESTING AUDIO AMPLIFIER.

Use figure 5 as a guide for setting up the testing circuit. Set the audio oscillator output at a value which will provide the rated output of the amplifier to its load. Match the load impedance of the amplifier with the load resistor across its output. Set the sweep circuit of the Handiscope to show two or three complete waveforms on the tube.

Incorrect bias in the amplifier will result in unequal half-cycles. Overloading of the amplifier is shown by flattening of both halves of the sine wave cycles.

AM RECEIVER ALIGNMENT

Always follow instructions from the receiver manufacturer when they are furnished. The following steps show the general procedure, but should be used only when receiver manufacturer's instructions are not available.

1. Set the COARSE FREQ. control at 90-500 cycles and the SYNC. switch at INT. Connect one side of the

voice coil winding or the control grid of the power output tube to VERT. INPUT. Connect the other side of the voice coil or the receiver ground to GND. on the Handiscope.

2. Tune an AM signal generator to the intermediate frequency of the receiver. Set the signal generator for an amplitude modulated signal.
3. Connect the signal generator output across the grid-to-ground input of the last IF amplifier, with a 100 $\mu\mu$f capacitor in series with the lead to the grid. If the receiver is an AC-DC type, connect a .02 μf capacitor in series with the generator lead to the receiver ground.
4. Turn on power in the generator and the receiver. Set the receiver volume control at maximum and adjust the signal generator output level for a barely audible signal in the receiver speaker.
5. Set the Handiscope controls for two or three complete waveforms with a small vertical deflection.
6. Adjust trimmers on the last IF transformers to obtain maximum vertical deflection on the oscilloscope. Reduce the generator output and the VERT. GAIN control on the Handiscope as required.
7. Move the signal generator connections to the grid of the next previous IF stage. Adjust its IF transformer trimmers for maximum Handiscope vertical deflection. Repeat this process backwards through the IF stages, adjusting each transformer for maximum vertical deflection.
8. Move the signal generator connections to the grid input of the mixer (also called converter and first detector)

stage. Adjust the trimmers of the first IF transformer for a maximum vertical deflection on the Handiscope.

9. Move the signal generator connections to the antenna and ground posts of the receiver. Tune the signal generator to 1400 kilocycles, with amplitude modulation. Set the receiver tuning control at 1400 kilocycles. Adjust the receiver oscillator trimmer and the RF tuning control trimmer for maximum vertical deflection on the Handiscope.
10. Tune the signal generator and the receiver to 600 kilocycles. Adjust the receiver oscillator series padder for maximum vertical deflection.
11. Repeat the adjustment at 1400 kc, then at 600 kc. There is some interaction between these two tuning points in the receiver.

FM AND TV ALIGNMENT

An oscilloscope is necessary for proper alignment in FM and TV receivers. The manufacturer's instructions are required for each application and should be followed exactly. All the controls which will be required, such as phasing and blanking, will be found on the front panel of the Handiscope.

REPAIR OR PARTS REPLACEMENT

A list of authorized Repair Stations and Parts Depots is shown in the rear of the manual. Contact your nearest Repair Station to obtain service or repair for your instrument. If you wish to order a replacement part, use the Simpson part number and send the order to your nearest Parts Depot.

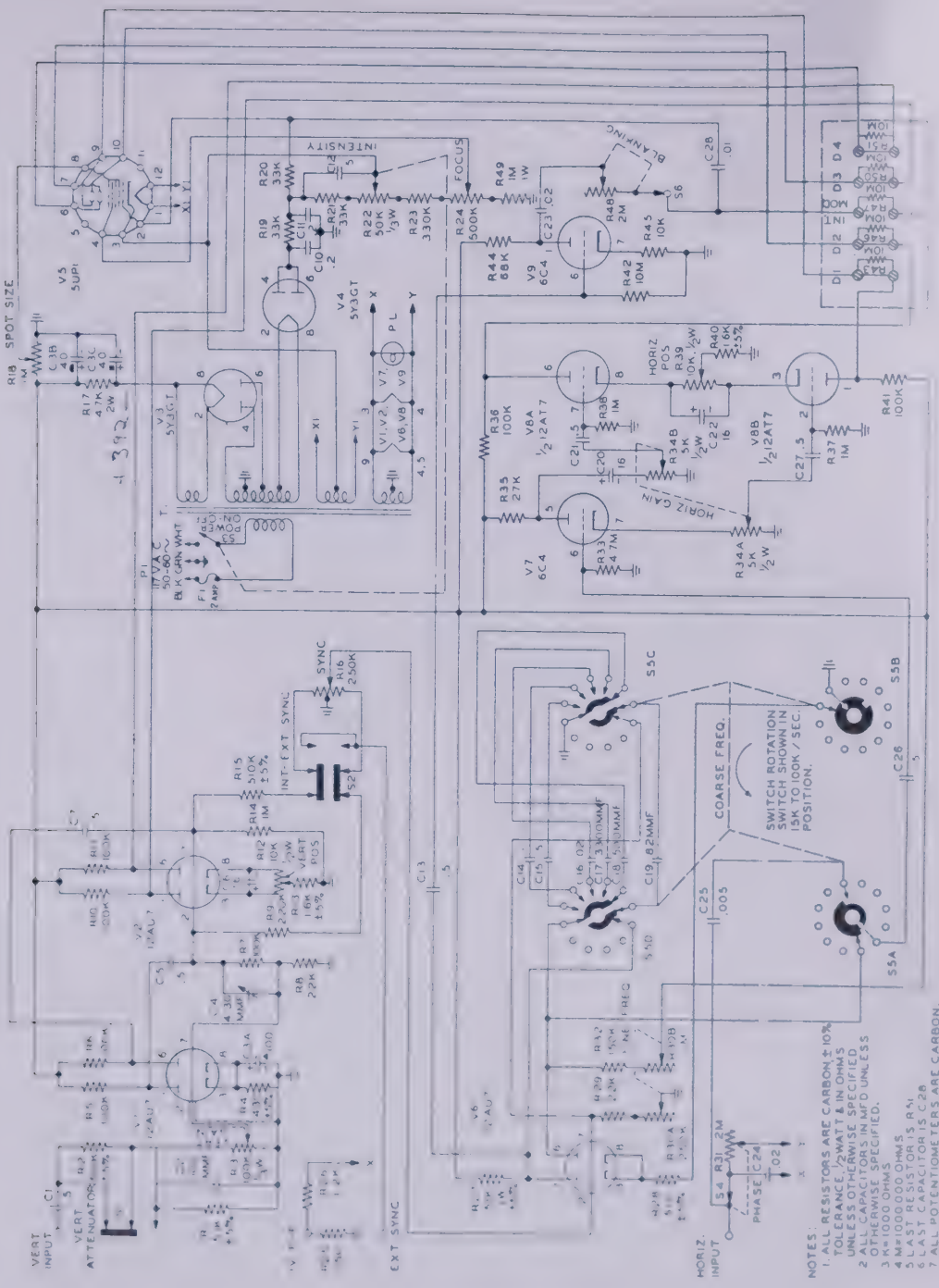
SPOT SIZE
INTENSITY
FOCUS
BLANKING
HORIZ POS
HORIZ GAIN
SYNC
INT-EXT SYNC
COARSE FREQ.
SWITCH ROTATION SWITCH SHOWN IN 15K TO 100K / SEC. POSITION.
VERT INPUT
VERT ATTENUATOR
EXT SYNC
HORIZ. INPUT
PHASE
NOTES:
1. ALL RESISTORS ARE CARBON ± 10% TOLERANCE, ½ WATT & IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS IN MFD UNLESS OTHERWISE SPECIFIED.
3. K = 1000 OHMS
4. M = 1000,000 OHMS
5. LAST 3 DIGITS OF S R's.
6. LAST CAPACITOR IS C28
7. ALL POTENTIOMETERS ARE CARBON, ¼ WATT, LINEAR TAPER, UNLESS OTHERWISE SPECIFIED.

FIGURE 6. SIMPSON HANDISCOPE MODEL 466, SCHEMATIC

FUSE

The power fuse is located on the lower side of the chassis near the rear inside the instrument. For access, disconnect the line cord from the power source and then remove the case of the Handiscope.

FREQUENCY RESPONSE

The frequency response of the vertical amplifier is affected by the adjustment of trimmer capacitor C4 inside the instrument. It is set at the factory to provide a response at 100 KC which is within −1 DB of its response at 500 cps. No change in the setting of this trimmer is necessary unless components are replaced in the vertical amplifier. When necessary, use the following steps to change the trimmer setting and maintain a satisfactory frequency response in the amplifier.

1. Disconnect the power cord from the power source.
2. Remove the case from the Handiscope.
3. Connect the power cord to the power source.
4. Connect a signal generator, a voltmeter, a voltage divider, and the Handiscope together as shown in figure 7. The signal generator must tune to 500 cps and to 100 KC. The voltmeter must have a response which is flat through 100 KC.
5. Set the signal generator frequency at 500 cps.

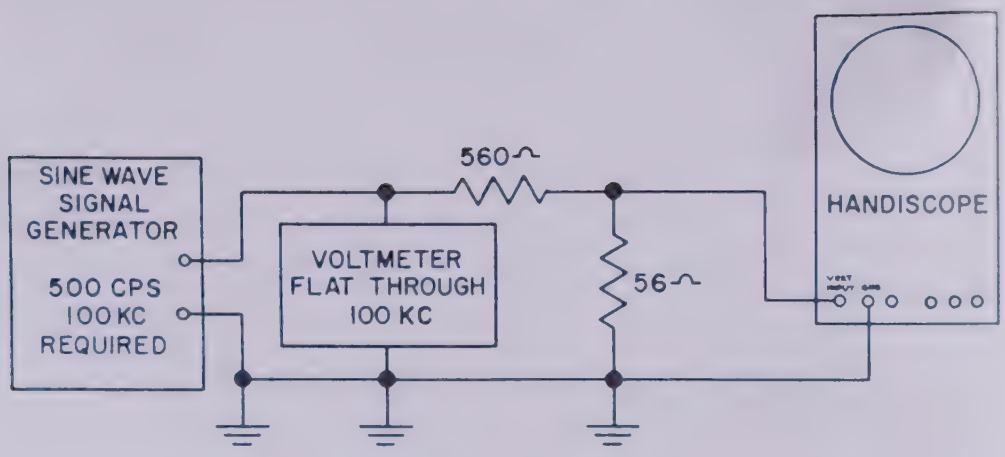

FIGURE 7. CONNECTIONS FOR ADJUSTING VERTICAL FREQUENCY RESPONSE.

6. Set the Handiscope controls as follows:
   VERT. ATTEN. at X1.
   VERT. GAIN at 10 (maximum).
   COARSE FREQ. at 500-3K position.
   FINE FREQ. for 3 or 4 cycles.
7. Adjust the signal generator output for a 4-inch peak-to-peak vertical deflection on the Handiscope.
8. Measure and record the signal generator output voltage as read on the voltmeter.
9. Change the signal generator frequency to 100 KC.
10. Change the COARSE FREQ. control on the Handiscope to the 15K-100K position. Adjust the FINE FREQ. control for 3 or 4 cycles.
11. Set the output level of the signal generator for the voltmeter reading recorded in step 8 above.
12. Adjust the trimmer, C4, in the Handiscope for a vertical deflection of 3.85 inches peak-to-peak.

SPOT SIZE

Potentiometer R18 in the Handiscope is factory adjusted for correct spot size. Aging or replacement of parts may require readjustment of this control to maintain the small spot size and fine-line trace which is desirable in the operation of the instrument.

When field adjustment is necessary, use the following procedure:

1. Disconnect the power cord from the power source.
2. Remove the case from the Handiscope.
3. Connect the power cord to the power source.
4. Set both VERT. GAIN and HORIZ. GAIN controls at 0 (minimum).
5. Use the VERT. POS. and HORIZ. POS. controls to center the spot on the face of the cathode ray tube.
6. Set the INTENSITY control for normal brightness.
7. Set the FOCUS control at mid range.
8. Adjust spot size control, R18 for the smallest spot on the cathode ray tube.

PARTS LIST

SYMBOL NO.	DESCRIPTION	SIMPSON PART NO.
C1	Capacitor, 0.5 mf, ±20%, 400 v	1-116963
C2	Capacitor, 100 mmf, ±10%, 500 v	1-113912
C3	Capacitor, 40-40-100 mf @450-450-50 v dc	1-116946
C4	Capacitor, trimmer, 4-30 mmf	1-116901
C5	Capacitor, 0.5 mf, ±20%, 400 v	1-116963
C6	Capacitor, 16 mf @150 v dc	1-112694
C7	Capacitor, 0.5 mf, ±20%, 400 v	1-116963
C10	Capacitor, 0.2 mf, ±20%, 1600 v	1-116947
C11	Capacitor, 0.2 mf, ±20%, 1600 v	1-116947
C12	Capacitor, 0.5 mf, ±20%, 200 v	1-116943
C13	Capacitor, 0.5 mf, ±20%, 200 v	1-116943
C14	Capacitor, 0.1 mf, ±20%, 400 v	1-113901
C15	Capacitor, 0.5 mf, ±20%, 400 v	1-116963
C16	Capacitor, 0.02 mf, ±20%, 400 v	1-113898
C17	Capacitor, 0.0033 mf, ±10%, 600 v	1-116972
C18	Capacitor, 500 mmf, ±10%, 500 v	1-117046
C19	Capacitor, 82 mmf, ±10%, 500 v	1-116971
C20	Capacitor, 16 mf @150 v dc	1-112694
C21	Capacitor, 0.5 mf, ±20%, 200 v	1-116943
C22	Capacitor, 16 mf @150 v dc	1-112694
C23	Capacitor, 0.02 mf, ±20%, 400 v	1-113898
C24	Capacitor, 0.02 mf, ±20%, 400 v	1-113898
C25	Capacitor, 0.005 mf +20% -0%, disc type	1-116559
C26	Capacitor, 0.5 mf, ±20%, 200 v	1-116943
C27	Capacitor, 0.5 mf, ±20%, 200 v	1-116943
C28	Capacitor, 0.01 mf, ±20%, 1600 v	1-115505
F1	Fuse, 2 ampere 250 volt, Type 3AG	1-112911
R1	Resistor, 5100 ohms, ±5%, ½ w	1-113046
R2	Resistor, 510 K, ±5%, ½ w	1-113951
R3	Potentiometer, 100 K, ±30%, linear taper	1-116961

PARTS LIST

SYMBOL NO.	DESCRIPTION	SIMPSON PART NO.
R4	Resistor, 430 ohms, ±5%, ½ w	1-116944
R5	Resistor, 100 K, ±10%, ½ w	1-113949
R6	Resistor, 100 K, ±10%, ½ w	1-113949
R7	Resistor, 100 K, ±10%, ½ w	1-113949
R8	Resistor, 22 K, ±10%, ½ w	1-113439
R9	Resistor, 220 K, ±10%, ½ w	1-114226
R10	Resistor, 100 K, ±10%, ½ w	1-113949
R11	Resistor, 100 K, ±10%, ½ w	1-113949
R12	Potentiometer, 10 K, ±30%, linear taper	1-116939
R13	Resistor, 1600 ohms, ±5%, ½ w	1-116965
R14	Resistor, 1 megohm, ±10%, ½ w	1-113952
R15	Resistor, 510 K, ±5%, ½ w	1-113951
R16	Potentiometer, 250 K, ±30%, tap at 125 K	1-116969
R17	Resistor, 4700 ohms, ±10%, 2 w	1-116698
R18	Potentiometer, 1 megohm, ±30%, linear taper	1-116979
R19	Resistor, 33 K, ±10%, ½ w	1-113945
R20	Resistor, 33 K, ±10%, ½ w	1-113945
R21	Resistor, 33 K, ±10%, ½ w	1-113945
R22	Potentiometer, 50 K, ±30%, linear taper, with SPST Switch S3	1-116967
R23	Resistor, 330 K, ±10%, ½ w	1-113950
R24	Potentiometer, 500 K, ±30%, linear taper	1-116966
R25	Resistor, 150 ohms, ±10%, ½ w	1-113926
R26	Resistor, 1200 ohms, ±10%, ½ w	1-114680
R27	Resistor, 51 K, ±5%, 1 w	1-114626
R28	Resistor, 510 ohms, ±5%, ½ w	1-116896
R29	Resistor, 22 K, ±10%, ½ w	1-113439
R30	Potentiometer, dual, 1 megohm ±30% and 250 K ±30%, linear tapers	1-116938
R31	Potentiometer, 2 megohms ±30%, with SPST switch	1-116968

PARTS LIST

SYMBOL NO.	DESCRIPTION	SIMPSON PART NO.
R32	Resistor, 150 K, ±10%, ½ w	1-113677
R33	Resistor, 4.7 megohms, ±10%, ½ w	1-115494
R34	Potentiometer, dual, 5 K ±10% each section	1-116952
R35	Resistor, 27 K, ±10%, ½ w	1-113944
R36	Resistor, 100 K, ±10%, ½ w	1-113949
R37	Resistor, 1 megohm, ±10%, ½ w	1-113952
R38	Resistor, 1 megohm, ±10%, ½ w	1-113952
R39	Potentiometer, 10 K, ±30%, linear taper	1-116939
R40	Resistor, 1600 ohms, ±5%, ½ w	1-116965
R41	Resistor, 100 K, ±10%, ½ w	1-113949
R42	Resistor, 10 megohms, ±10%, ½ w	1-111693
R43	Resistor, 10 megohms, ±10%, ½ w	1-111693
R44	Resistor, 68 K, ±10%, ½ w	1-114803
R45	Resistor, 10 K, ±10%, ½ w	1-111671
R46	Resistor, 10 megohms, ±10%, ½ w	1-111693
R47	Resistor, 10 megohms, ±10%, ½ w	1-111693
R48	Potentiometer, 2 megohms, ±30%, with SPST switch	1-116968
R49	Resistor, 1 megohm, ±10%, 1 w	1-116964
R50	Resistor, 10 megohms, ±10%, ½ w	1-111693
R51	Resistor, 10 megohms, ±10%, ½ w	1-111693
S1	Switch, 1 section, 2 positions	1-116940
S2	Switch, slide, DPDT	1-116942
S3	Switch, SPST, part of R22	see R22
S4	Switch, SPST, part of R31	see R31
S5	Switch, COARSE FREQ. 6 positions, 4 sections	1-116970
S6	Switch, SPST, part of R48	see R48
T1	Power Transformer	1-116948
V1	Tube, type 12AU7	3-811944
V2	Tube, type 12AU7	3-811944
V3	Tube, type 5Y3GT	1-114671
V4	Tube, type 5Y3GT	1-114671

PARTS LIST

SYMBOL NO.	DESCRIPTION	SIMPSON PART NO.
V5	Tube, cathode ray, type 5UP1	1-114369
V6	Tube, type 12AU7	1-114083
V7	Tube, type 6C4	1-113975
V8	Tube, type 12AT7	1-115466
V9	Tube, type 6C4	1-113975
	Knobs, large (eight used)	1-115546
	Knobs, small (four used)	1-115658
	Bezel, cathode ray tube	1-116953
	Graticule	1-116960
	Input cable assembly	0100
	P1 Power Cable	1-110614